



DOE-EM/GJ947-2005

299-E13-06 (A5854) Log Data Report

Borehole Information:

Borehole: 299-E13-06 (A5854)		Site: 216-B-19 Crib			
Coordinates (WA St Plane)		GWL ¹ (ft): 347.6		GWL Date: 02/14/05	
North (m)	East (m)	Drill Date	Top of Casing Elevation (ft)	Total Depth (ft)	Type
134341.797	573564.077	11/55	747.29	364	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	1.4	6 5/8	6 1/8	1/4	1.4	100
Welded steel	0	8	unknown	unknown	0	364

Borehole Notes:

Casing diameter measurements were acquired using a caliper and steel tape. Measurements were rounded to the nearest 1/16 in. The 8-in. casing was not visible at the ground surface. Casing depths are derived from *Hanford Wells* (Chamness and Merz 1993). Groundwater level was reported at 364 and 338.7 ft in October 1955 and January 1992, respectively. The logging engineer measured the groundwater level at approximately 346.6 ft in 2005.

Logging Equipment Information:

Logging System:	Gamma 1E	Type:	SGLS (70%) SN: 34TP40587A
Effective Calibration Date:	03/04/05	Calibration Reference:	DOE-EM/GJ864-2005
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 1C	Type:	HRLS (planar) SN: 39A314
Effective Calibration Date:	04/06/05	Calibration Reference:	DOE-EM/GJ865-2005
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat	
Date	03/08/05	03/30/05	03/31/05	03/31/05	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	100.0	230.0	345.0	230.0	
Finish Depth (ft)	2.0	98.0	231.0	195.0	
Count Time (sec)	100	100	100	100	

Log Run	1	2	3	4 Repeat	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A ²	N/A	N/A	N/A	
Pre-Verification	AE044CAB	AE045CAB	AE046CAB	AE046CAB	
Start File	AE044000	AE045000	AE046000	AE046115	
Finish File	AE044098	AE045131	AE046114	AE046150	
Post-Verification	AE045CAA	AE045CAA	AE046CAA	AE046CAA	
Depth Return Error (in.)	0	- 1	0	0	
Comments	No fine gain adjustment.				

High Rate Logging System (HRLS) Log Run Information:

Log Run	5	6 Repeat			
Date	04/12/05	04/12/05			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	19.0	17.0			
Finish Depth (ft)	12.0	14.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			
Pre-Verification	AC128CAB	AC128CAB			
Start File	AC129000	AC129008			
Finish File	AC129007	AC129011			
Post-Verification	AC129CAA	AC129CAA			
Depth Return Error (in.)	0	N/A			
Comments	No fine gain adjustment.	No fine gain adjustment.			

Logging Operation Notes:

Logging was conducted with a centralizer on the sonde between depths of 2 and 100 ft. Below 100 ft, no centralizer was used. Logging data acquisition is referenced to the top of casing. The maximum logging depth was 345 ft, approximately 1 ft above groundwater. Repeat sections were collected in this borehole to evaluate system performance.

Analysis Notes:

Analyst:	Henwood	Date:	08/04/05	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. The acceptance criteria were met.

A combined casing correction for 0.602-in.-thick casing (0.28+0.322) was applied to the log data between the ground surface and 100 ft. Below 100 ft a casing correction for 0.322-in. thick casing was used. Casing thicknesses are derived from published values for ASTM schedule 40 steel casing.

SGLS and HRLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1Emar05.xls and G1CApr05.xls for the SGLS and HRLS, respectively,

using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied to the SGSL data when it exceeds 11.4 percent and where the HRLS exceeds 10.8 percent. No correction for water was necessary.

HRLS data are substituted where the SGSL dead time exceeds 40 percent.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs , ^{60}Co , and ^{125}Sb) detected in the borehole, naturally occurring radionuclides (^{40}K , ^{238}U , ^{232}Th [KUT]), a combination of man-made, KUT, and dead time, and total gamma plotted with dead time. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. Repeat log sections are also included. A comparison plot of the Waste Management Federal Services Radionuclide Logging System (RLS) log data acquired in 1999 and the current SGSL data is provided. Also included is a plot of historical total gamma data acquired between 1956 and 1976 and the current SGSL total gamma data.

Results and Interpretations:

^{137}Cs was detected between 11 and 51 ft. Concentrations ranged between approximately 0.2 pCi/g (MDL) and 200,000 pCi/g. The maximum concentration was measured at 16 ft. ^{137}Cs was also detected near its MDL at a few isolated depth locations between 210 and 310 ft

^{60}Co was detected between 22 and 176 ft with a maximum concentration of approximately 0.3 pCi/g at 44 ft. It is possible ^{60}Co also exists in the high activity zone between 12 and 22 ft.

^{125}Sb was detected between 24 and 30 ft with a maximum concentration of approximately 2.4 pCi/g at 27 ft. It is possible ^{125}Sb also exists in the high activity zone between 12 and 22 ft.

The comparison plot of SGSL and RLS man-made radionuclides indicates consistent profiles after the RLS data are decayed to the current date. The profiles suggest no significant changes have occurred since 1999.

The comparison plot of the current SGSL total gamma data and historical total gamma data (1976) show elevated activity between approximately 10 and 30 ft. The 1956 data show significant activity between approximately 10 and 80 ft. The maximum extent of contamination is shown in 1963, extending to approximately 200 ft. By 1968, significant decay of short-lived radionuclides is shown from approximately 30 to 200 ft; current log data indicate ^{60}Co in this interval. The 1976 total gamma data suggest relatively long lived radionuclides (consistent with ^{137}Cs) exist in the sediments between 10 and 30 ft.

The repeat section indicates good agreement of the naturally occurring radionuclides.

References:

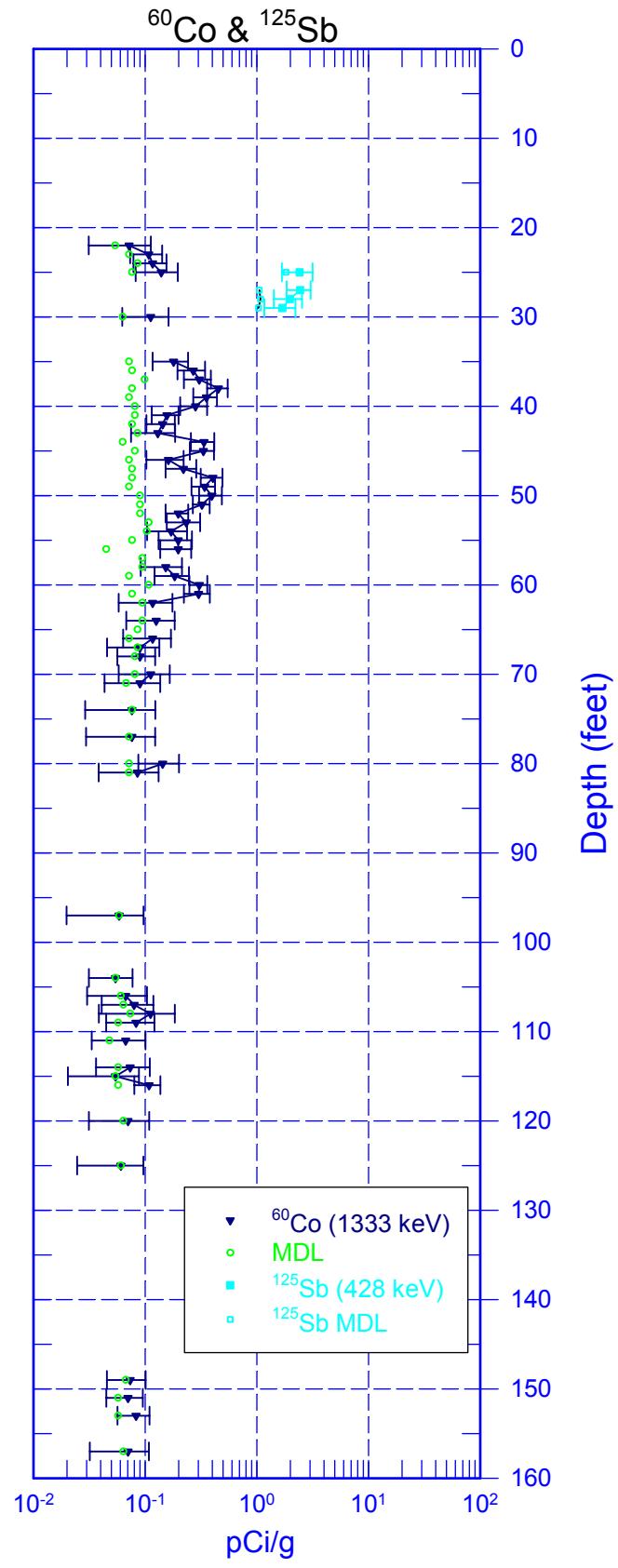
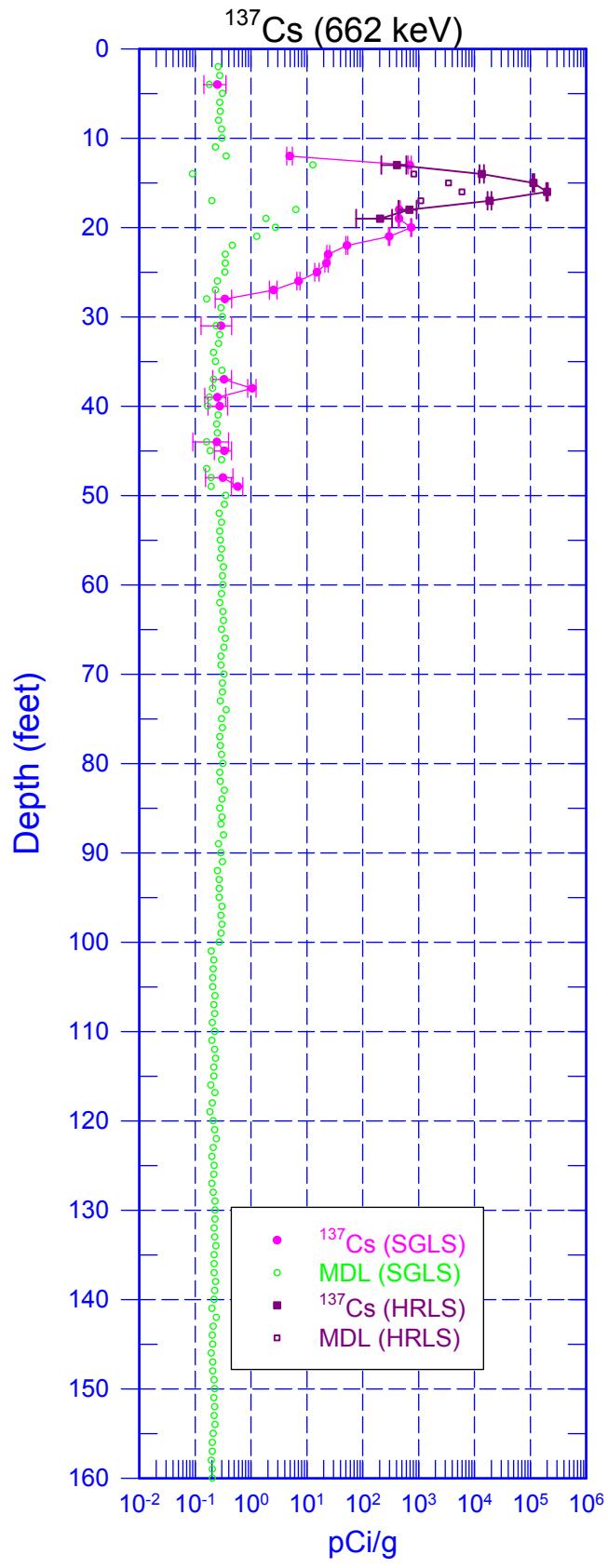
Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

¹ GWL – groundwater level

² N/A – not applicable

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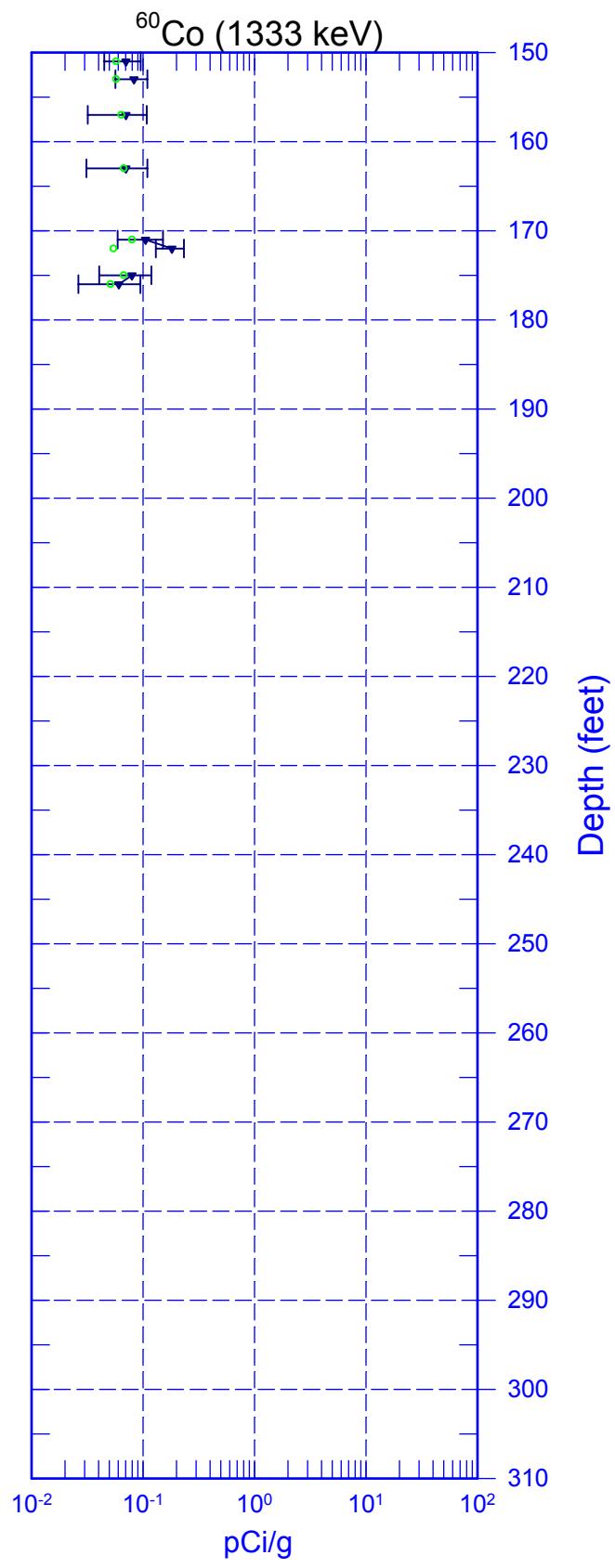
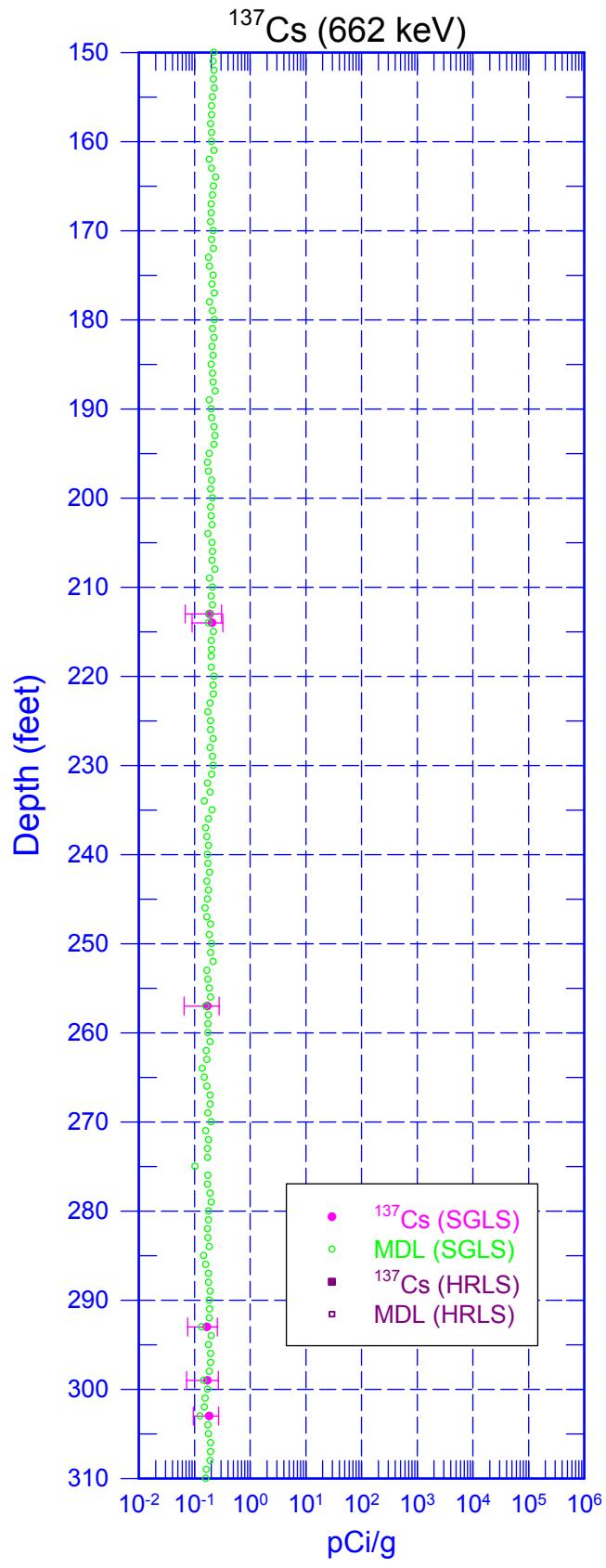
Man-Made Radionuclides



Zero Reference = Top of Casing

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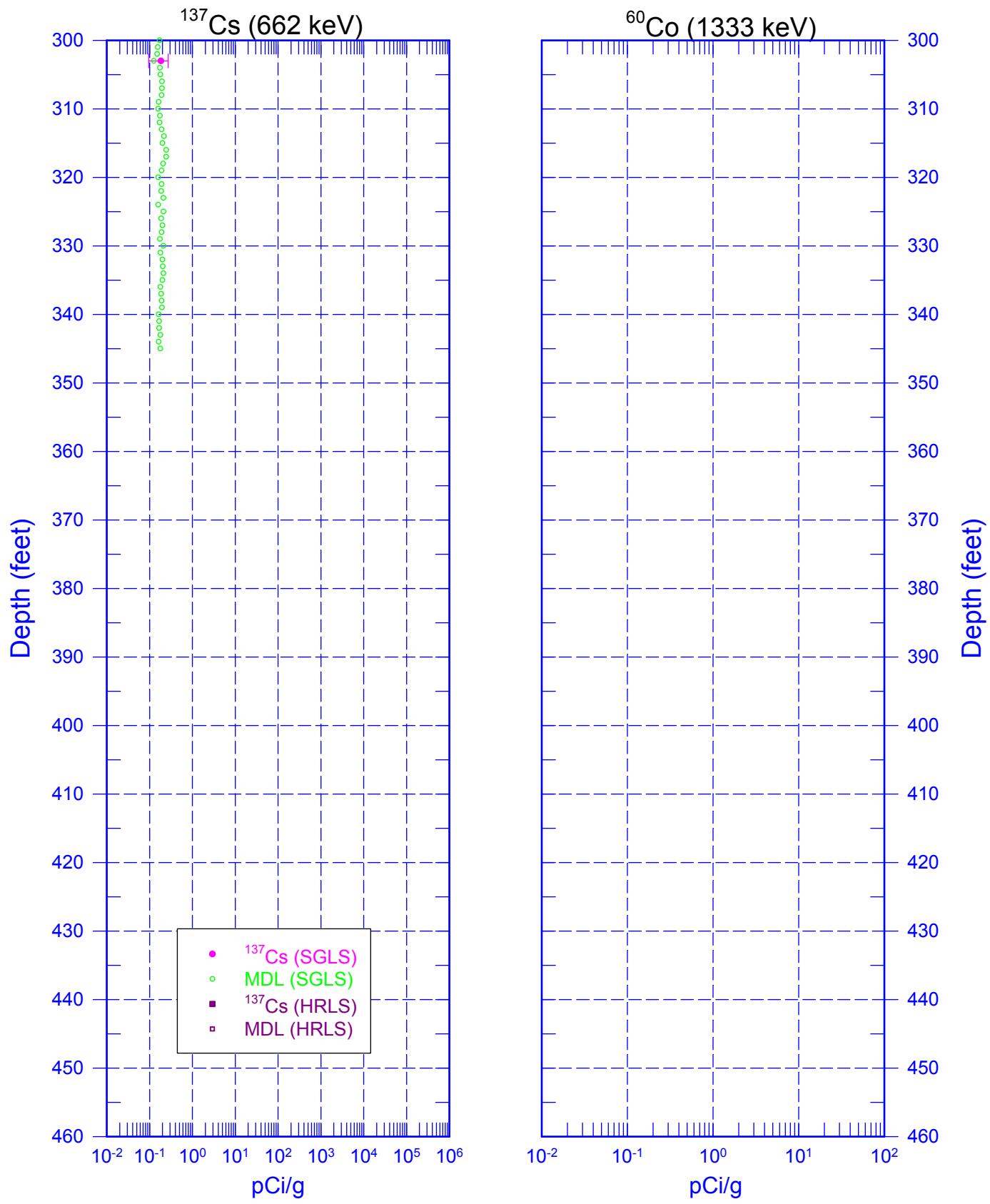
Man-Made Radionuclides



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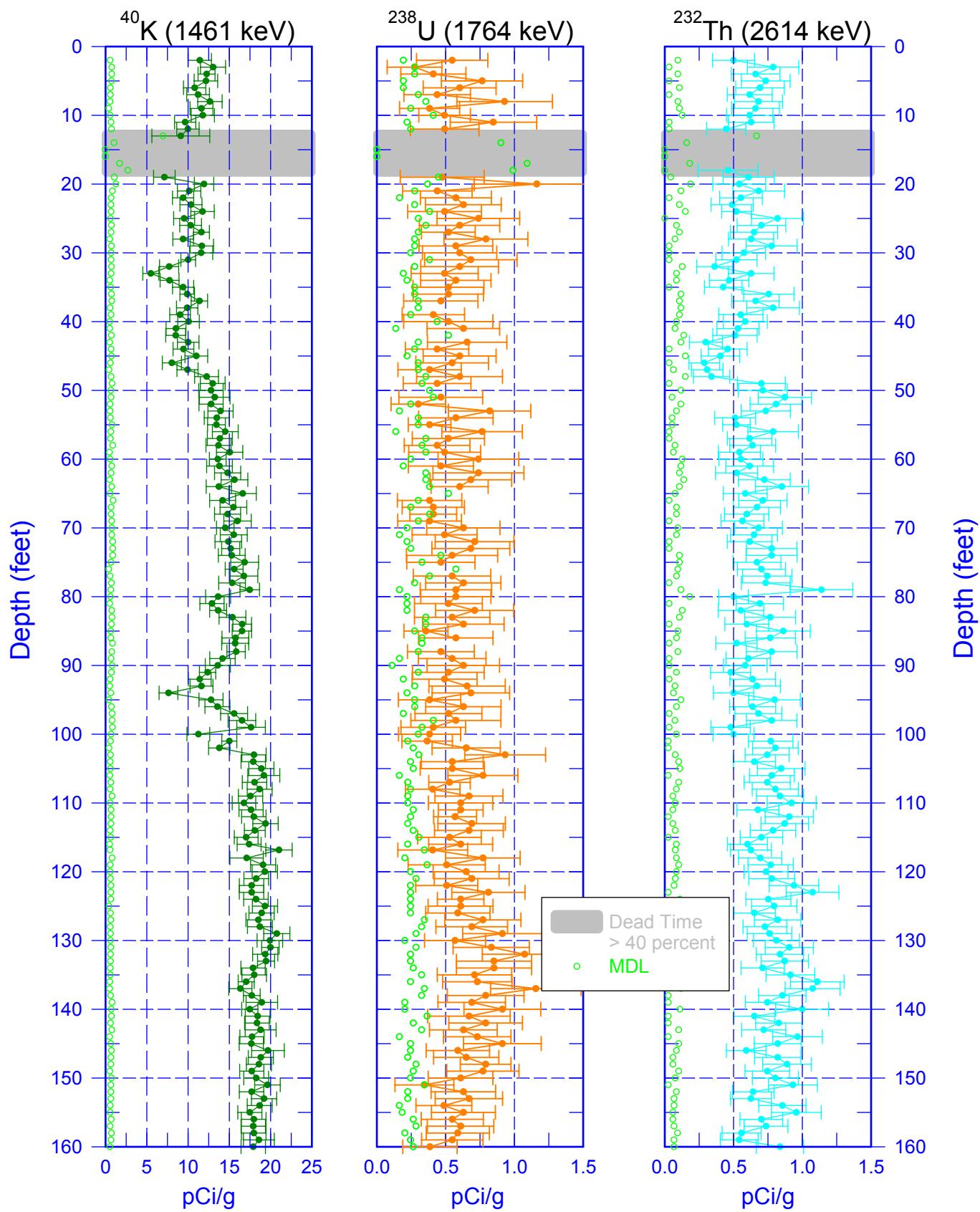
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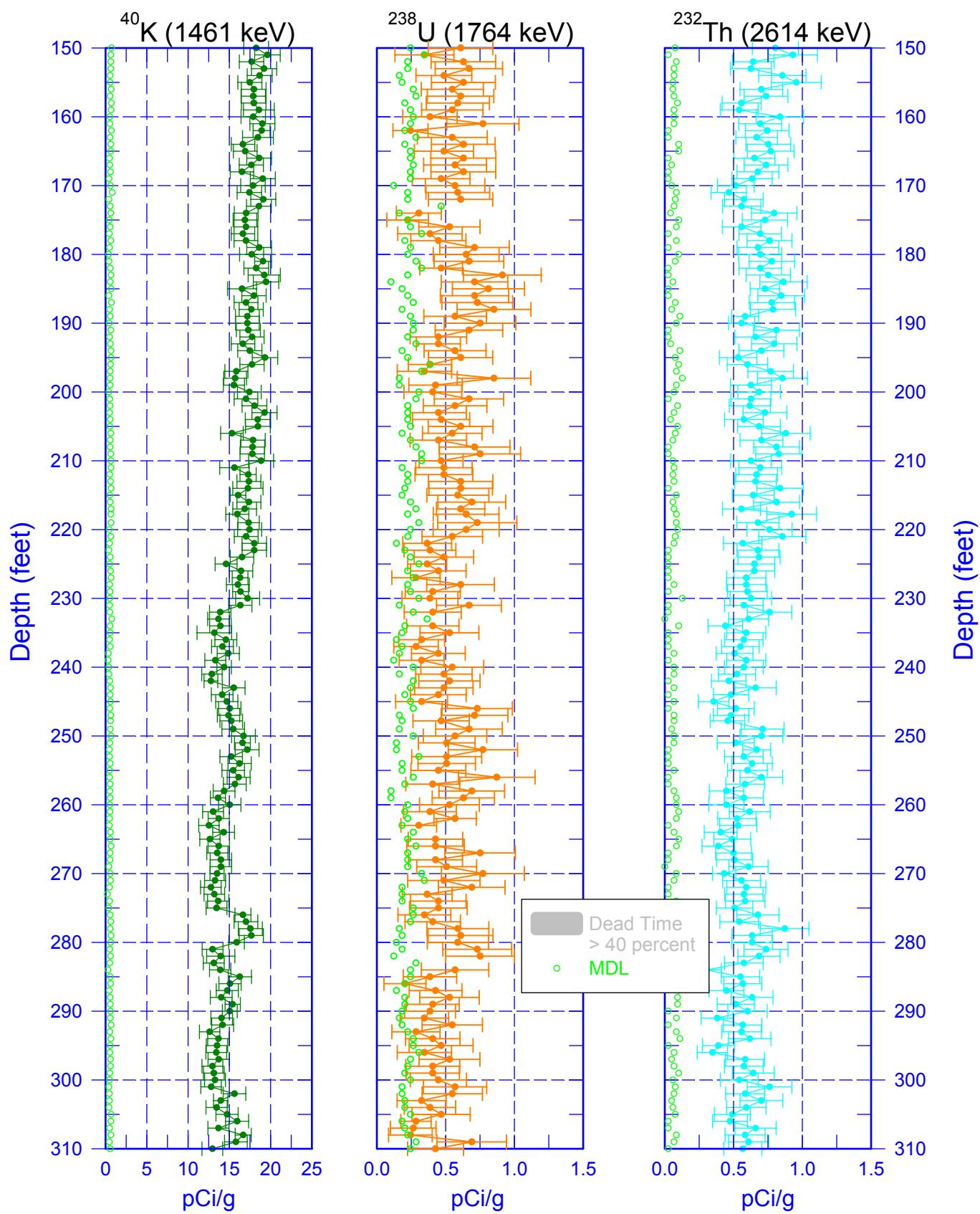
Natural Gamma Logs



Zero Reference = Top of Casing

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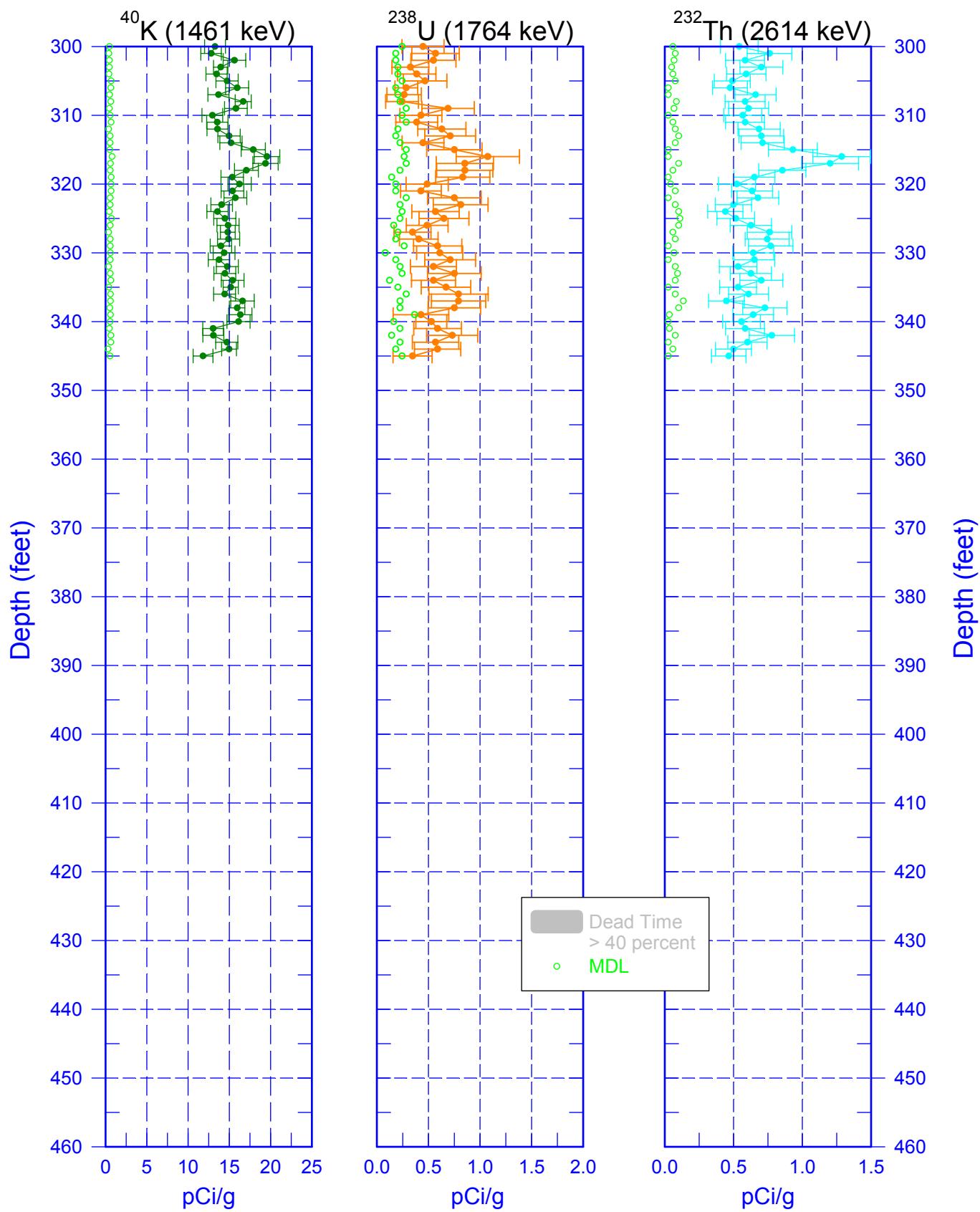
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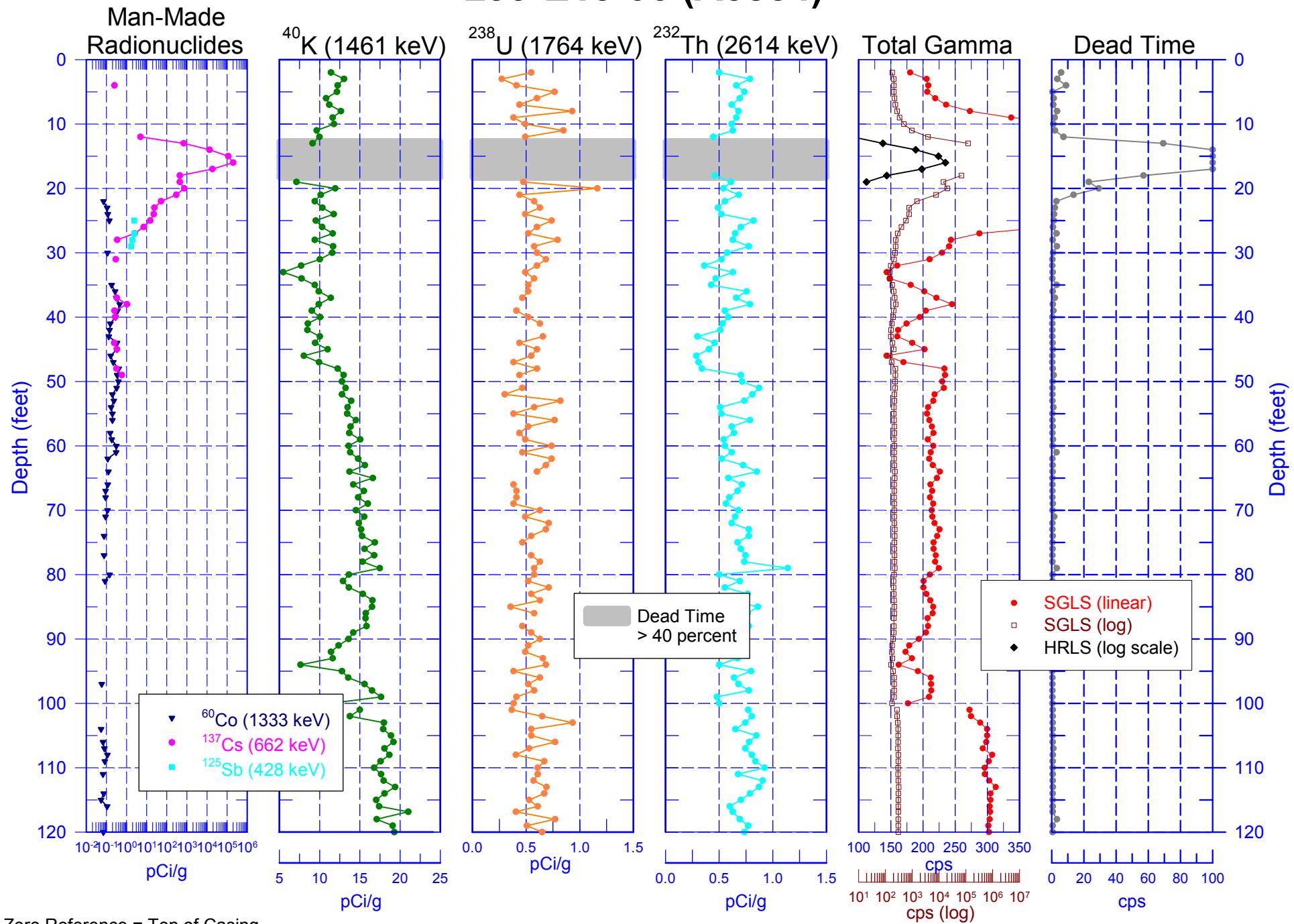
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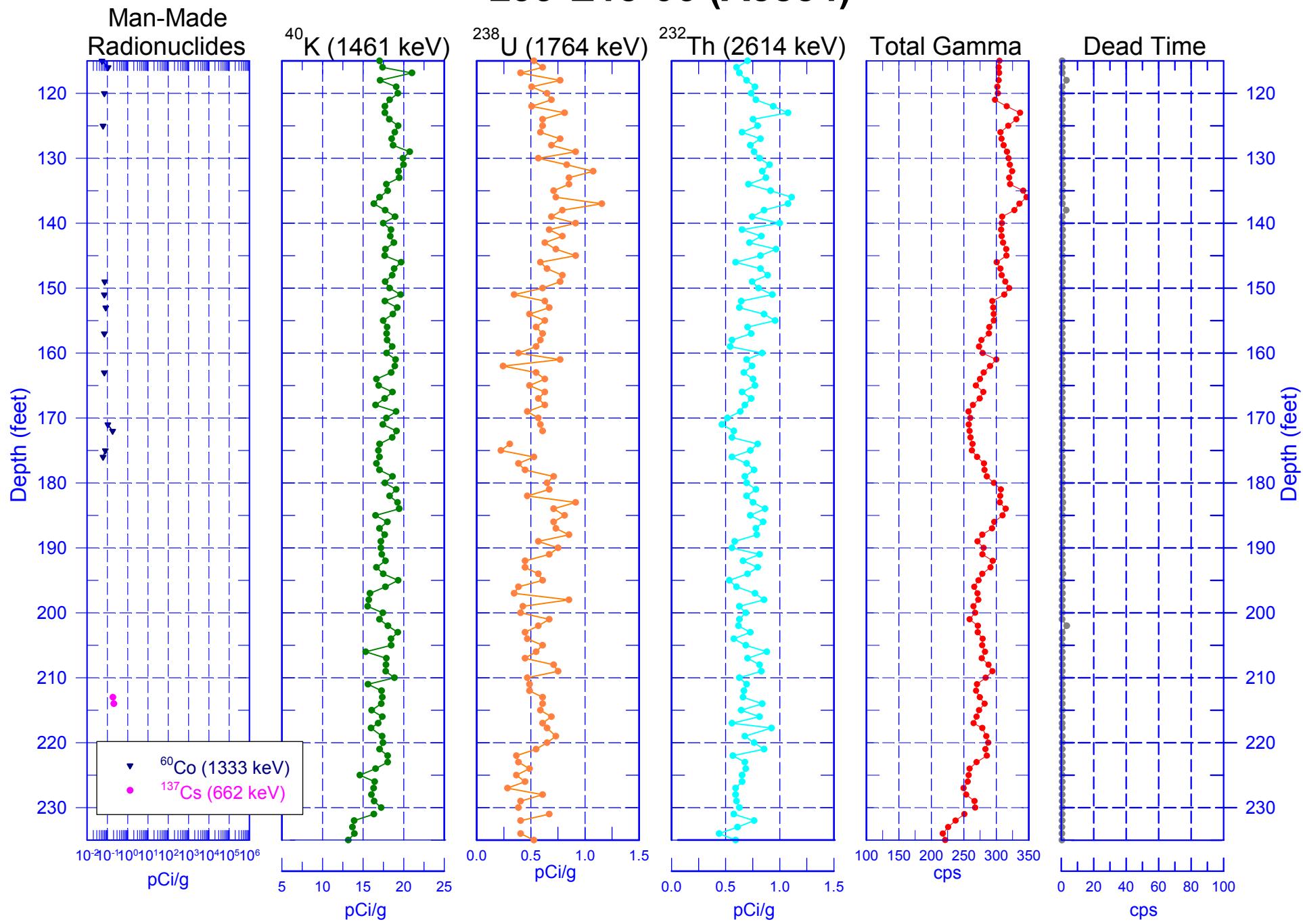


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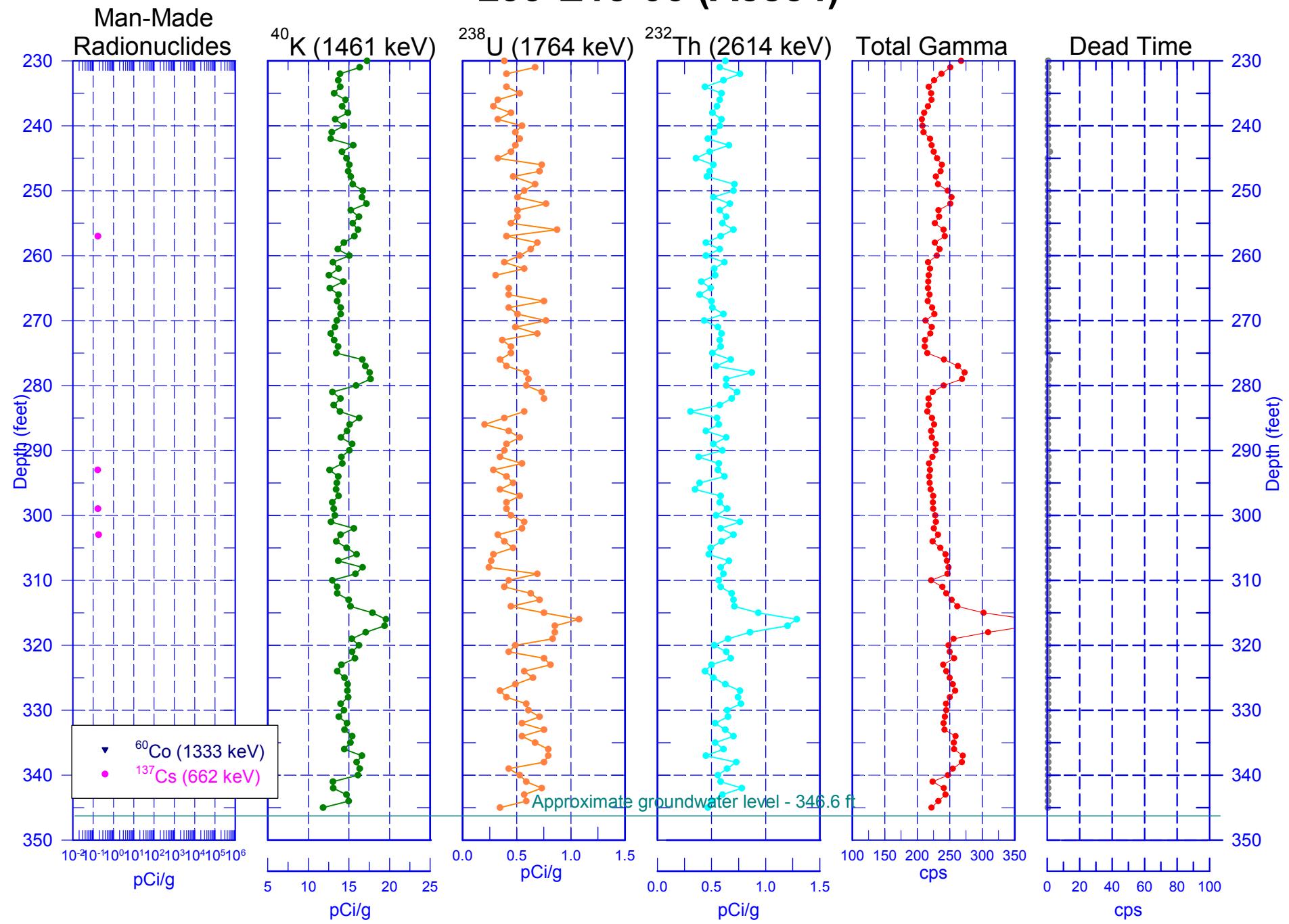


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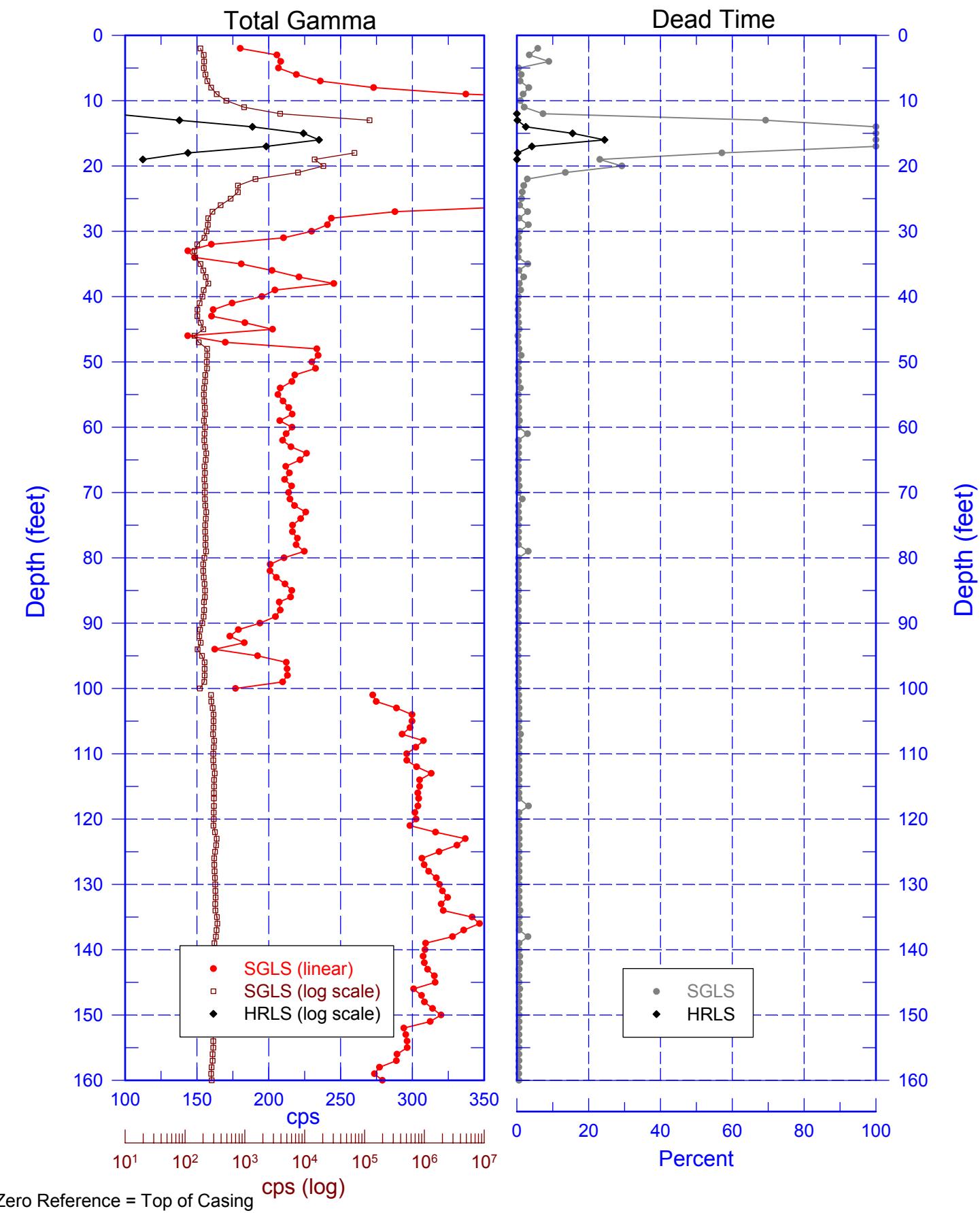


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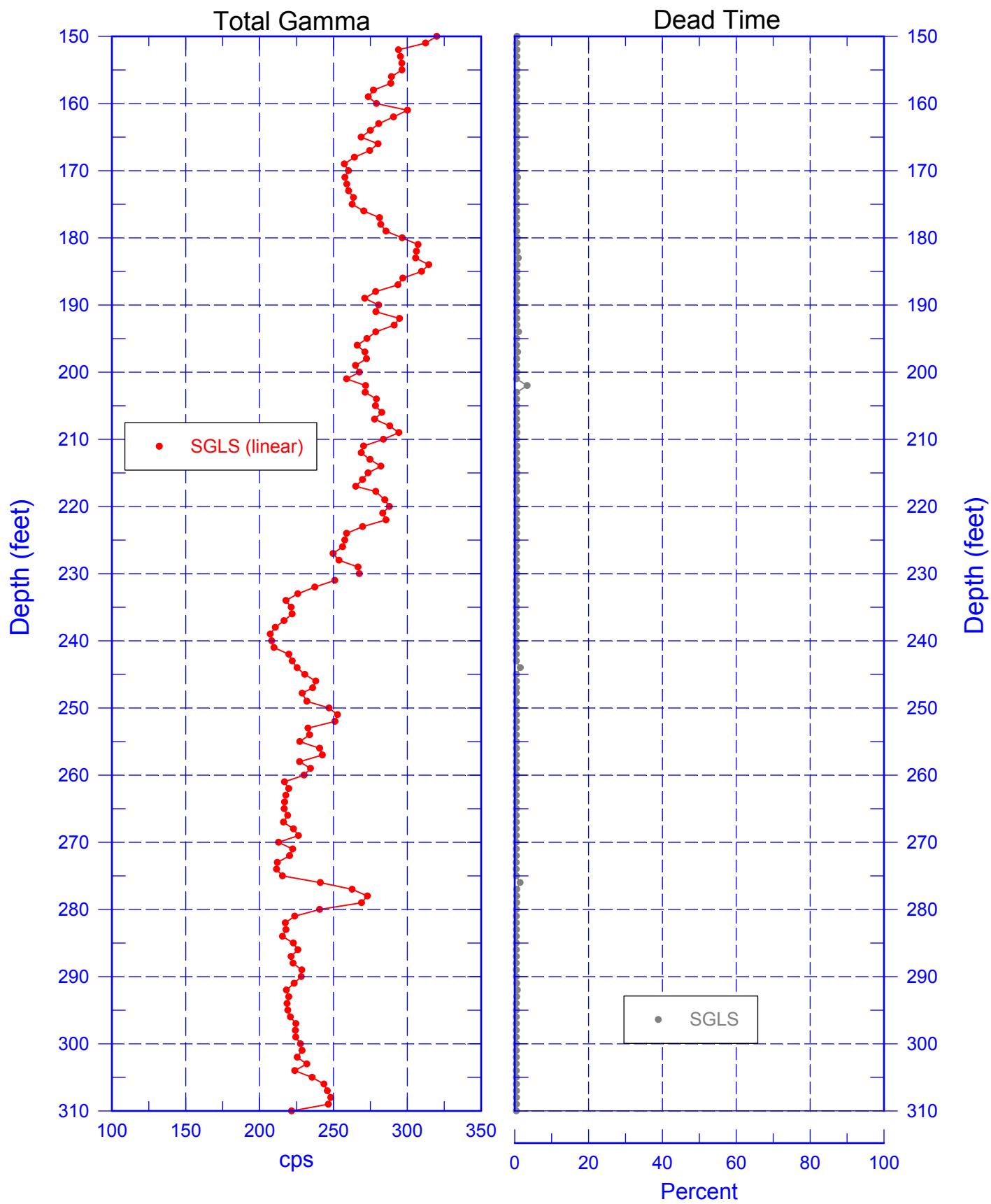


299-E13-06 (A5854) Total Gamma & Dead Time



299-E13-06 (A5854)

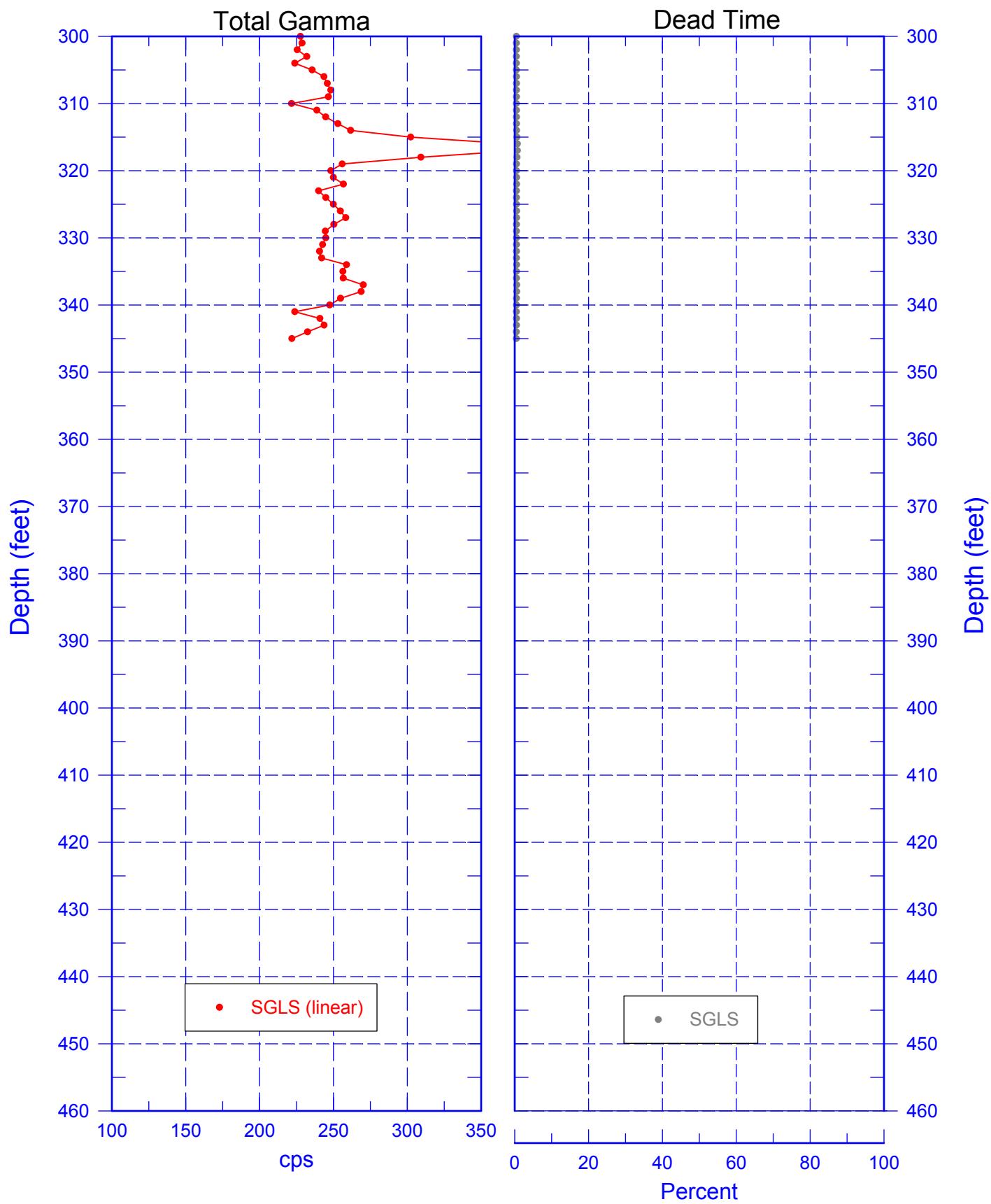
Total Gamma & Dead Time



Zero Reference = Top of Casing

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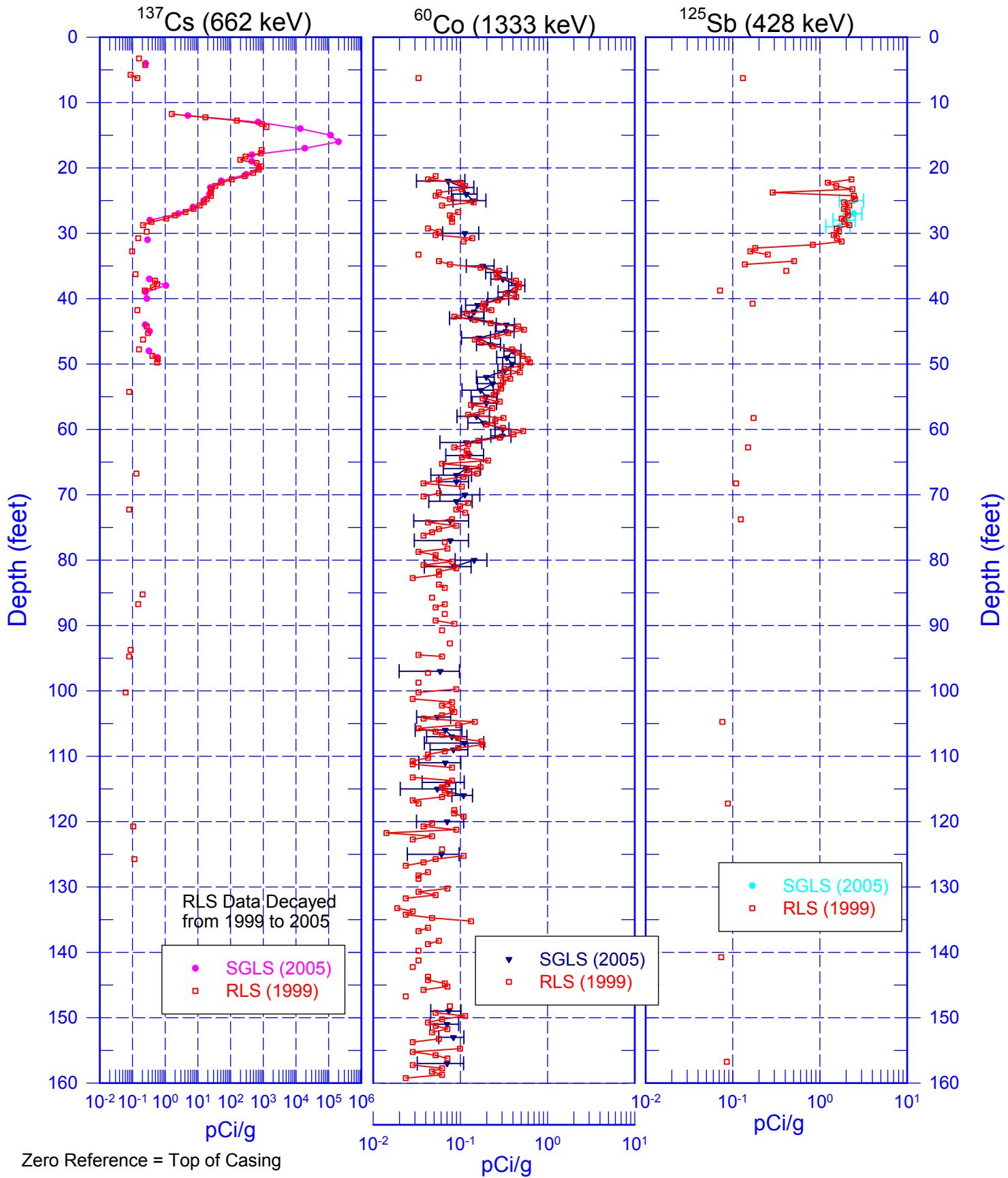
Total Gamma & Dead Time



Zero Reference = Top of Casing

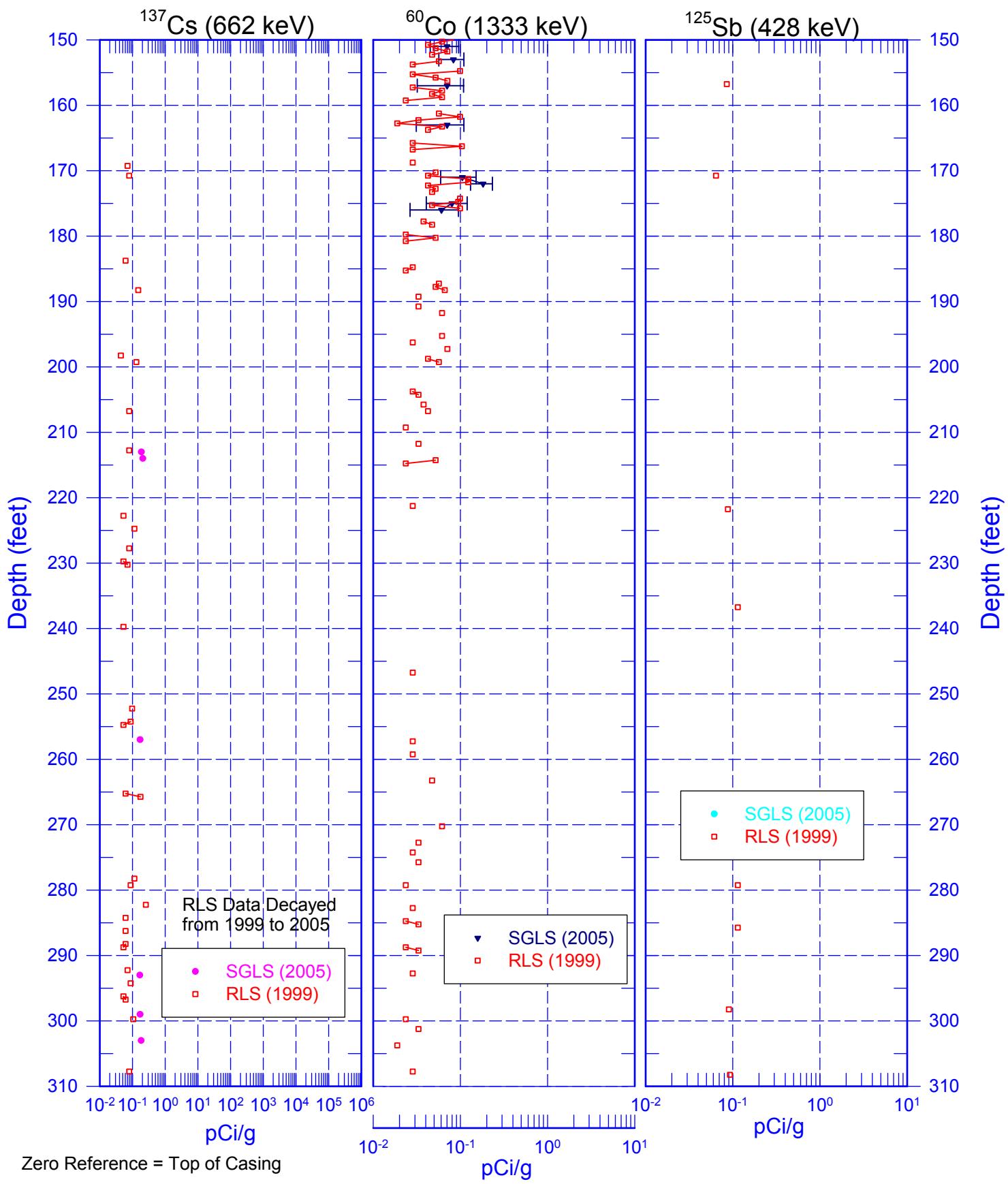
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SGLS & RLS Man-Made Radionuclide Comparison



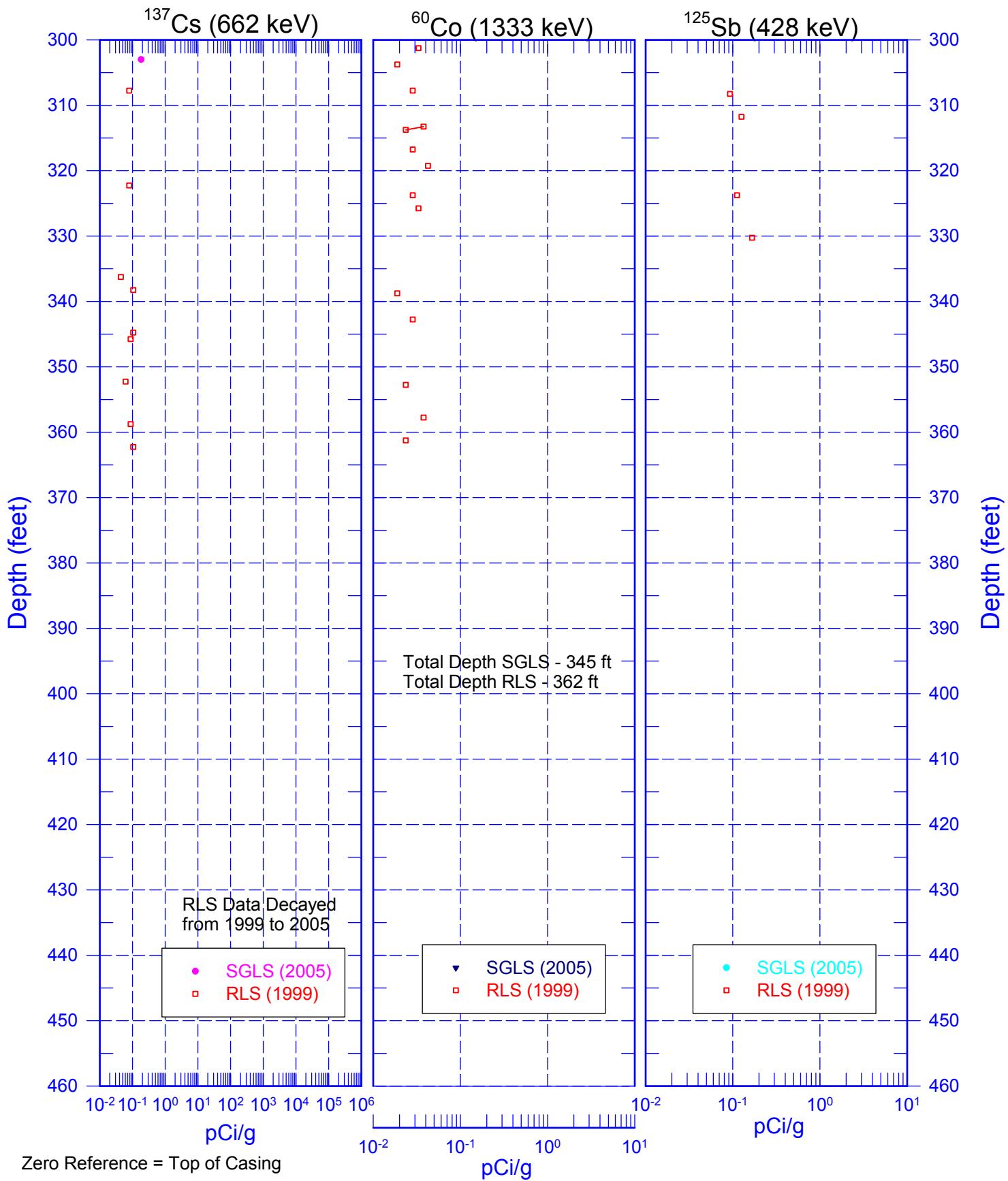
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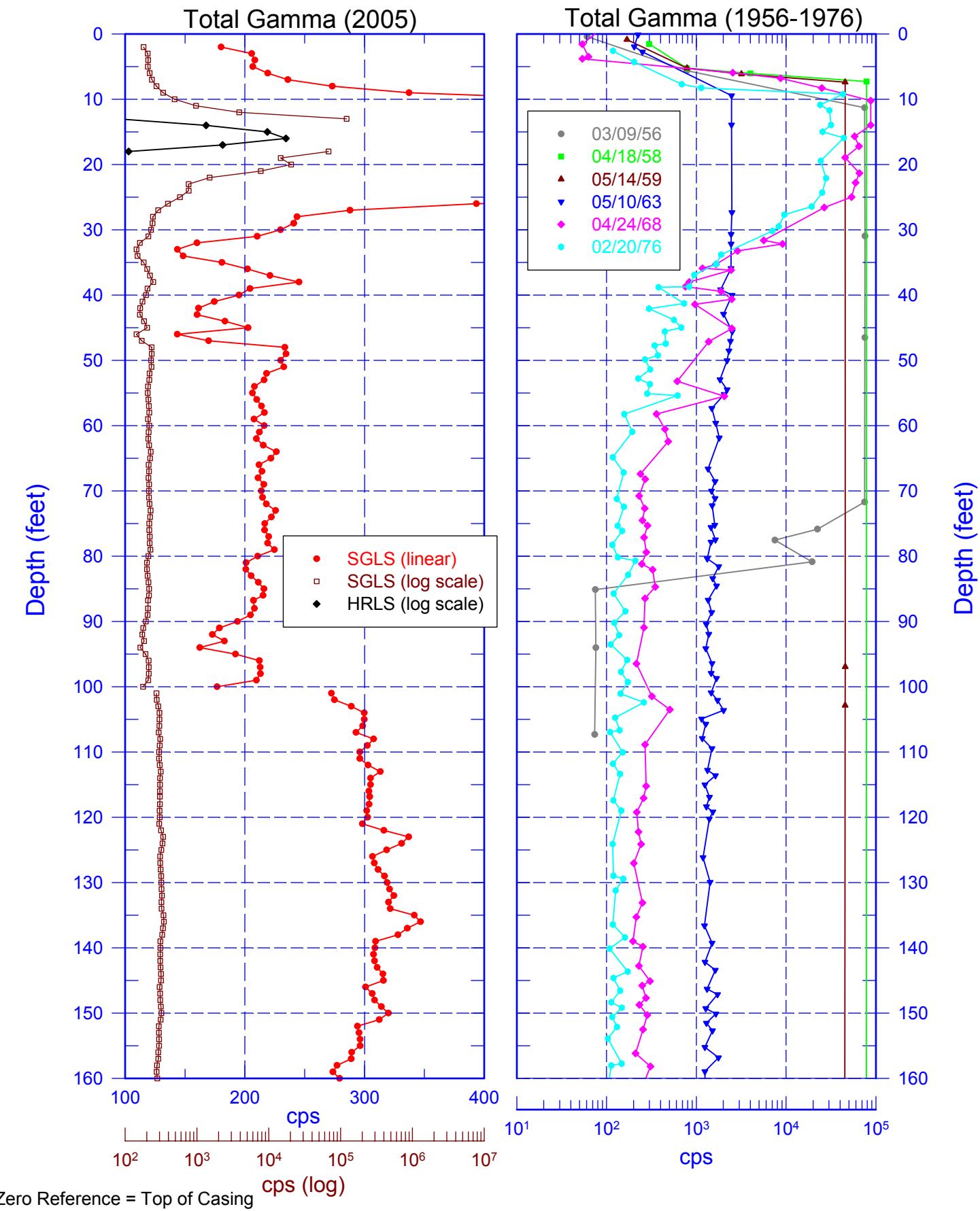
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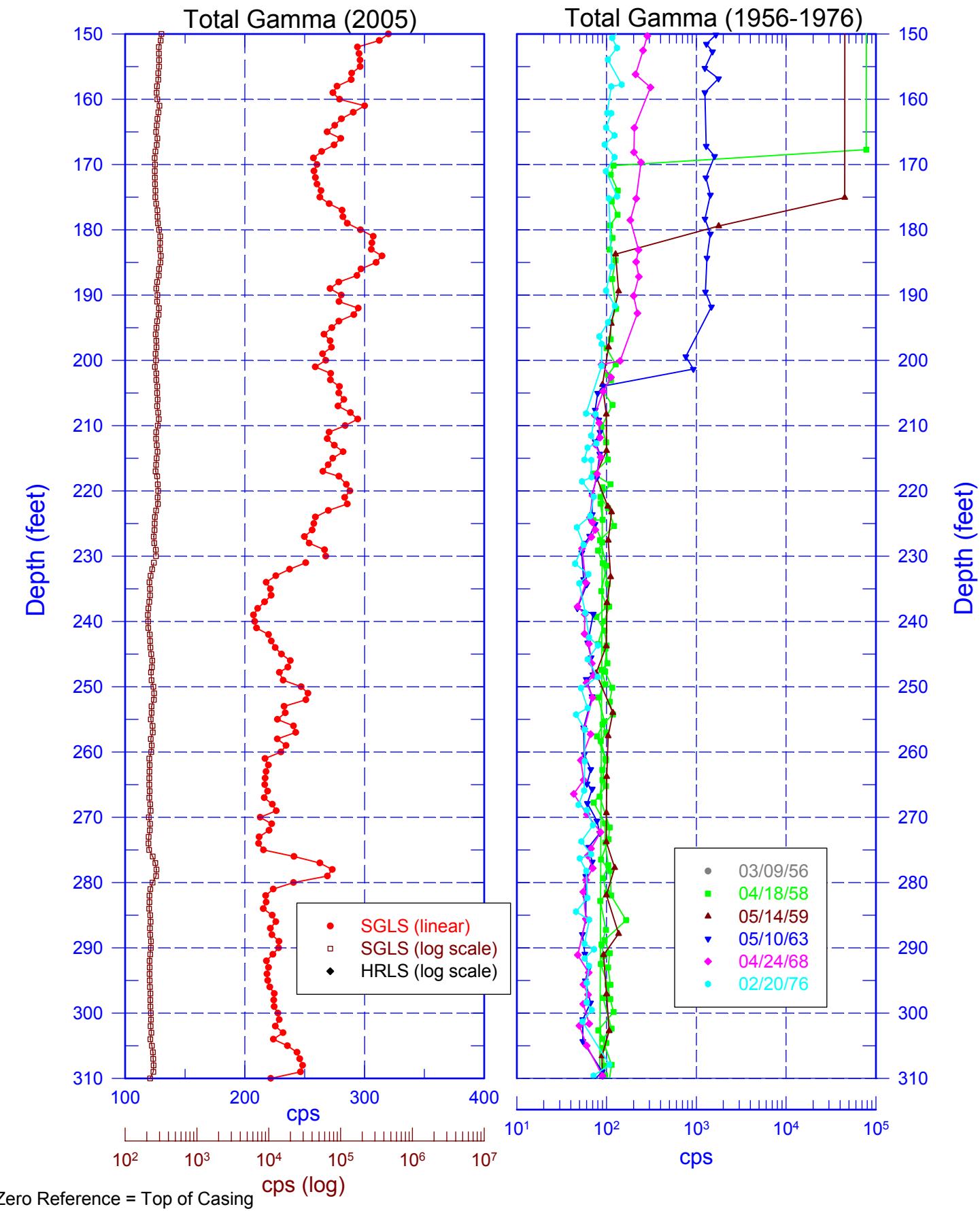
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Total Gamma Logs



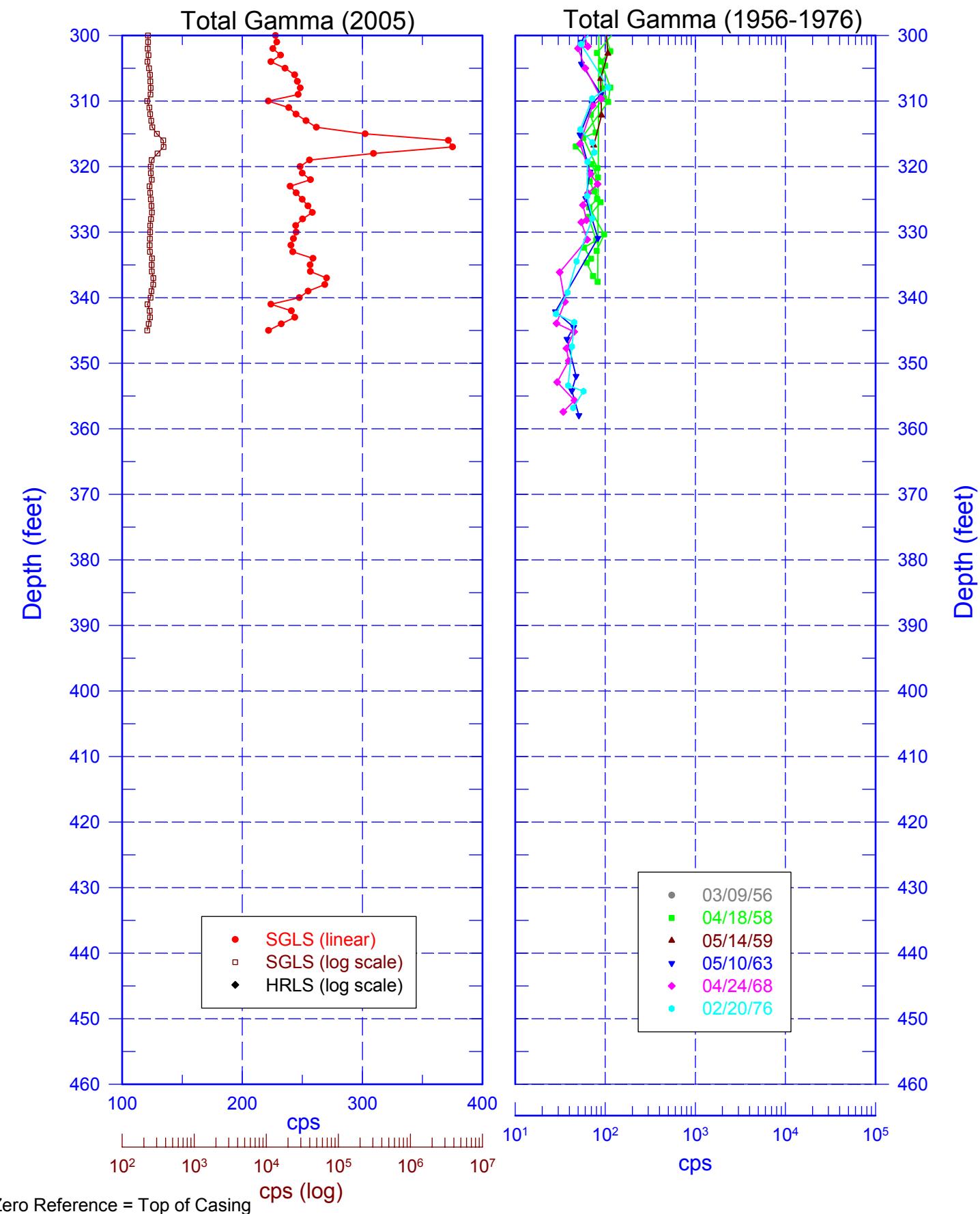
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Total Gamma Logs



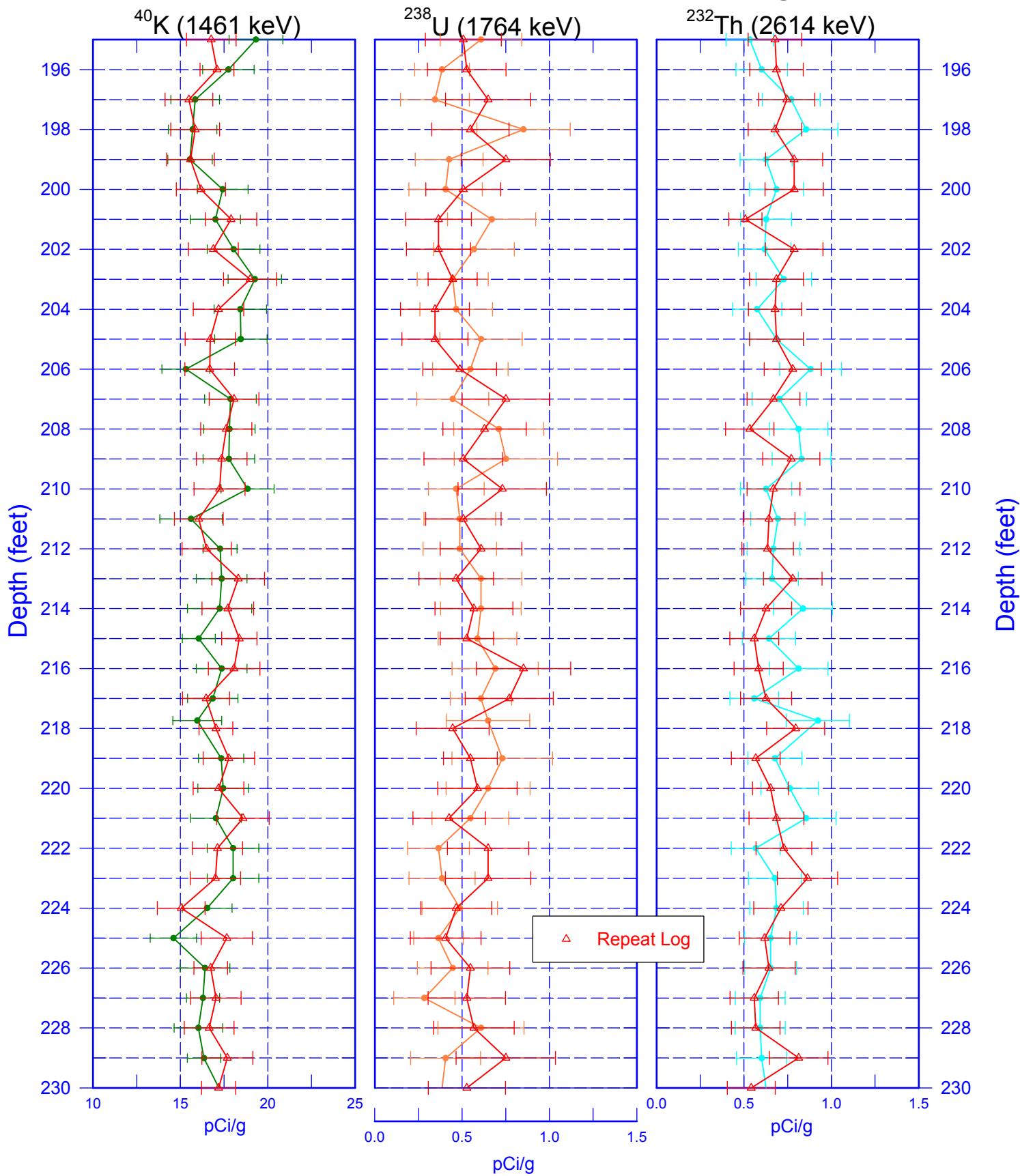
299-E13-06 (A5854)

Total Gamma Logs



299-E13-06 (A5854)

Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing